WATER RESOURCES RESEARCH GRANT PROPOSAL

Project ID: KY2801

Title: Does waste amendment affect abiotic N cycling in soils by naturally occurring reactive Fe(II)?

Focus Categories: Hydrogeochemistry, Nitrate Contamination

Keywords: denitrification, chemodenitrification, water quality

Start Date: 03/01/2001

End Date: 02/28/2002

Federal Funds: $7,500

Non-Federal Matching Funds: $15,000

Congressional District: Sixth

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Abstract

Redox reactions that affect nitrogen (N) speciation in soils, sediments, and natural waters will influence sustainable agriculture and environmental preservation. It is usually assumed that denitrification occurs strictly as a biologically mediated process. Surprisingly, recent studies indicate that denitrification occurs in conditions where it would not be expected and has been linked to the presence of Fe(II). Amending soils with animal waste is an ever increasing practice, which could affect the coordination environment and subsequent reactivity of Fe(II) in soils. Furthermore, since nitric oxide and nitrous oxide are two major products of abiotic denitrification (chemodenitrification) the extent of this process could have a significant impact on the production of greenhouse gases that enter the atmosphere through agricultural activities. However, there is little mechanistic information available concerning reactivity of naturally occurring Fe(II) in different coordination environments. The major objective of this proposed study is to investigate the role of naturally occurring soil Fe(II)-bearing minerals in the mediation of N redox cycling as affected by animal waste additions. Advanced analytical and in situ spectroscopic techniques will be used to identify reaction mechanisms. The kinetic studies will be invaluable in making sound decisions related to animal waste additions to soil. Data generated from this proposed study will provide the basis for assessing the impact of Fe(II)-mediated redox transformations on the fate of nitrate in natural settings. These results will assist in the sustainability of agriculture and industry, both of which are faced with costly decisions in regard to sludge and animal waste additions to agricultural lands.